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UNPUBLISHED PRELIMINARY DATA

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QUARTERLY REPORT ON RESEARCH CONTRACT #R-38 WITH NASA, COVERING PERIOD JANUARY-FEBRUARY-MARCH, 1964

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I. HUMAN ENERGETICS - Naval Med. Res. Inst.

Certain consequences for human engineering and space-technology were drawn from the results of experimental work performed under Contract [redacted] R-38 since 1960, during the present quarterly period. A system was proposed in which the physiologic central warm-sensor would operate as the main link of a man-made control-loop in a space-suit. One objective is to obtain control of internal body-temperature, without application of a temperature-sensor to the body. Another objective is to circumvent certain disadvantages of sweating (circulatory stress, odors, skin-disorders, waste of water through contamination, and other factors), by replacement of the artificially controlled physiologic response, sweating, with an artificial cooling system.

II. MOLECULAR ENERGETICS -

Report by Lutz Kiesow, M.D., D.Sc., Principal Investigator, Chemosynthesis-Project:

In the report covering the preceding period (October-November-December 1963) a "Mechanism of Elementary Biosynthesis" had been disclosed, in which the formation of reduced diphosphopyridine-nucleotide, DPN.H, is achieved under simultaneous oxidation of nitrite to nitrate, only when in a coupled, driving reaction electrons are transferred through a cytochrome-chain for terminal acceptance by molecular oxygen.

During the present period (January-February-March 1964) the reason why the two reaction-sequences are coupled, was discovered:

The compound which is common to both reactions (being a product of the driving process and a reactant of the driven process) is Adenosinetriphosphate, ATP. The driving process is the terminal reaction-sequence of cell-respiration with oxygen. The driven reaction is elementary biosynthesis itself, proceeding through the initial section of the respiratory chain and utilizing one part of the chain of enzymes in reverse. Simultaneous nitrite-oxidation, or light as a source of energy, are indispensable to overcome the energy-barrier which otherwise opposes DPN-reduction.

The driving reaction generates three moles of ATP in consuming one mole of DPN.H. The driven reaction consumes one mole of ATP in generating one mole of DPN.H. Thus every cycle of the coupled reactions, using one mole of Nitrite, achieves a net biosynthetic gain of 2/3 mole DPN.H., or 2 moles of ATP, respectively. Depending on the rates at which the two reactions proceed, any different but equivalent mixture of the two energy-donors may be obtained.

In this way the energy from inorganic sources is converted into the energy of the two biological donors, DPN.H and ATP. These are required for the reductive or phosphorylating steps on which the assimilation of carbon and the synthesis of higher organic compounds depend. The "Energy-Multiplying Cycle" explains the phenomenon of elementary biosynthesis without the classical, hypothetical assumptions of either direct phosphorylation of ATP, or direct reduction of Carbon Dioxide by inorganic-chemical or electro-magnetic energy.